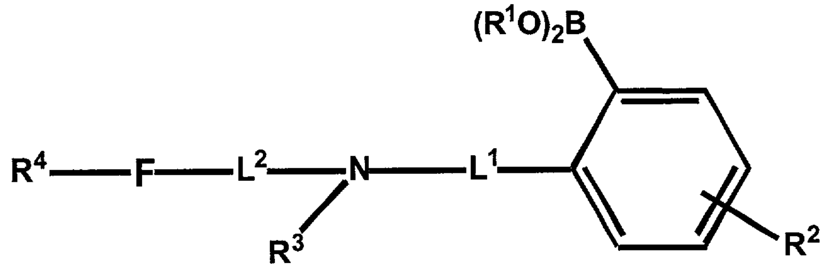
CLAIMS

1. A polymer composition comprising a fluorescent boronic acid of the general formula:



wherein:

F is a fluorophore;

N is a nitrogen atom;

B is a boron atom;

R^1 is selected from the functional group consisting of hydrogen, aliphatic and aromatic groups, wherein the functional group $(R^1O)_2B$ is capable of binding glucose;

R^2, R^3 and R^4 are optional and independent hydrogen, aliphatic or aromatic groups, further functionalized aliphatic or aromatic groups or groups that are capable of forming a covalent linkage to the polymer matrix;

L^1 and L^2 are optional linking groups having from zero to four atoms selected from the group consisting of nitrogen, carbon, oxygen, sulfur and phosphorous; and

wherein the polymer composition further includes a reference fluorophore; and wherein the fluorescent boronic acid and the reference fluorophore are covalently coupled to the polymer matrix after polymerization; and

further wherein:

the polymer composition including the covalently coupled reference fluorophore and the covalently coupled fluorescent boronic acid is soluble in an aqueous environment; and

the fluorescence of the polymer composition including the covalently coupled reference fluorophore and the covalently coupled fluorescent boronic acid increases in the presence of bound glucose.

2. The polymer composition of claim 1, wherein the polymer composition further includes an additional polymer that is coupled to the polymer matrix after polymerization; and wherein the additional polymer enhances the biocompatibility, swellability or hydrophilicity of the polymer composition.

3. The polymer composition of claim 2, wherein the polymer matrix is a block copolymer.

4. The polymer composition of claim 2, wherein the additional polymer is grafted on to the polymer matrix.

5. The polymer composition of claim 2, wherein the additional polymer is a polyethyleneoxide or polyethyleneoxide-polypropyleneoxide compound.

6. The polymer composition of claim 2, wherein the polymer matrix is crosslinked.

7. The polymer composition of claim 6, wherein the polymer matrix is crosslinked with polyethyleneoxide or polyethyleneoxide-polypropyleneoxide compounds.

8. The polymer composition of claim 1, wherein the nitrogen atom in the fluorescent boronic acid is covalently coupled to the polymer matrix after polymerization via the group designated R^3

9. The polymer composition of claim 8, wherein the atoms that link the fluorescent boronic acid to the polymer matrix of the polymer composition enhance the solubility of the polymer composition.

10. The polymer composition of claim 1, wherein the polymerized matrix is a polyvinylalcohol.

11. The polymer composition of claim 1, wherein the polymerized matrix is a polystyrene.

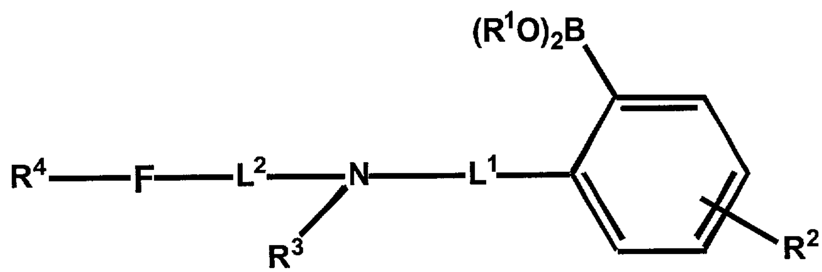
12. The polymer composition of claim 11, wherein the tether that links the polymer matrix (PM) to the fluorescent boronic acid (FBA) includes the following atoms: PM-CO-NH-FBA; PM-SO_2-

NH-FBA; PM-CO-NH-FBA; PM-COO-FBA; PM-NH-COO-FBA; PM-NH-CO-N-FBA or PM-NH-SO_2-FBA, wherein C denotes carbon, N denotes nitrogen, O denotes oxygen, S denotes sulfur and H denotes hydrogen.

13. The polymer composition of claim 1, wherein the fluorophore is highly soluble in water.

14. The polymer composition of claim 13, wherein the fluorophore is Nile Blue.

15. A polymer composition comprising a fluorescent boronic acid and a reference fluorophore; wherein the composition is produced by a process of covalently coupling the fluorescent boronic acid and the reference fluorophore to a polymerized matrix, wherein the fluorescent boronic acid has the general formula:



wherein:

F is a fluorophore;

N is a nitrogen atom;

B is a boron atom;

$R^1$is selected from the functional group consisting of hydrogen, aliphatic and aromatic groups, wherein the functional group $(R^1O)_2B$ is capable of binding glucose;

R^2, $R^3$and R^4 are optional and independent hydrogen, aliphatic or aromatic groups, further functionalized aliphatic or aromatic groups or groups that are capable of forming a covalent linkage to the polymer matrix;

L^1 and L^2 are optional linking groups having from zero to four atoms selected from the group consisting of nitrogen, carbon, oxygen, sulfur and phosphorous; and

wherein the polymer composition including the covalently coupled reference fluorophore and the covalently coupled fluorescent boronic acid is soluble in an aqueous environment; and

the fluorescence of the polymer composition including the covalently coupled reference fluorophore and the covalently coupled fluorescent boronic acid increases in the presence of bound glucose.

16. The polymer composition of claim 15, wherein the polymer composition further includes an additional polymer that is covalently coupled to the polymerized matrix; and wherein the additional polymer enhances the solubility of the polymer composition.

17. The polymer composition of claim 16, wherein the polymerized matrix is a block copolymer.

18. The polymer composition of claim 16, wherein the additional polymer is grafted on to the polymerized matrix.

19. The polymer composition of claim 16, wherein the additional polymer is a polyethyleneoxide or polyethyleneoxide-polypropyleneoxide compound.

20. The polymer composition of claim 16, wherein the polymerized matrix is crosslinked.

21. The polymer composition of claim 20, wherein the polymerized matrix is crosslinked with polyethyleneoxide or polyethyleneoxide-polypropyleneoxide compounds.

22. The polymer composition of claim 15, wherein the nitrogen atom in the fluorescent boronic acid is covalently coupled to the polymerized matrix via the group designated R^3.

23. The polymer composition of claim 22, wherein the atoms that link the fluorescent boronic acid to the polymerized matrix of polymer composition enhance the solubility of the polymer composition.

24. The polymer composition of claim 15, wherein the polymerized matrix is a polyvinylalcohol.

25. The polymer composition of claim 15, wherein the polymerized matrix is a polystyrene.

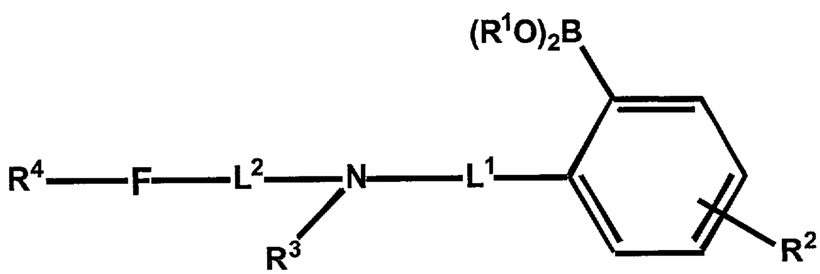
26. The polymer composition of claim 25, wherein the tether that links the polymer matrix (PM) to the fluorescent boronic acid (FBA) includes the following atoms: PM-CO-NH-FBA; PM-SO_2-NH-FBA; PM-CO-NH-FBA; PM-COO-FBA; PM-NH-COO-FBA; PM-NH-CO-N-FBA or PM-NH-SO_2-FBA, wherein C denotes carbon, N denotes nitrogen, O denotes oxygen, S denotes sulfur and H denotes hydrogen.

27. The polymer composition of claim 15, wherein the fluorophore is highly soluble in water.

28. The polymer composition of claim 27, wherein the fluorophore is Nile Blue.

29. A method of making a polymer composition comprising a fluorescent boronic acid and a reference fluorophore, the method comprising the steps of:

covalently coupling the fluorescent boronic acid and the reference fluorophore to a polymerized matrix, wherein the fluorescent boronic acid has the general formula:



wherein:

F is a fluorophore;

N is a nitrogen atom;

B is a boron atom;

R^1 is selected from the functional group consisting of hydrogen, aliphatic and aromatic groups, wherein the functional group $(R^1O)_2B$ is capable of binding glucose;

R^2, R^3 and R^4 are optional and independent hydrogen, aliphatic or aromatic groups, further functionalized aliphatic or aromatic groups or groups that are capable of forming a covalent linkage to the polymer matrix;

L^1 and L^2 are optional linking groups having from zero to four atoms selected from the group consisting of nitrogen, carbon, oxygen, sulfur and phosphorous; and

wherein the polymer composition including the covalently coupled reference fluorophore and the covalently coupled fluorescent boronic acid is soluble in an aqueous environment; and

the fluorescence of the polymer composition including the covalently coupled reference fluorophore and the covalently coupled fluorescent boronic acid increases in the presence of bound glucose.

30. The method of claim 29, further including the step of covalently coupling an additional polymer to the polymerized matrix; and wherein the additional polymer enhances the solubility of the polymer composition.

31. The method of claim 30, wherein the additional polymer is grafted on to the polymerized matrix.

32. The method of claim 31, wherein the additional polymer is a polyethyleneoxide or polyethyleneoxide-polypropyleneoxide compound.

33. The method of claim 29, further including the step of covalently crosslinking the polymer composition.

34. The method of claim 33, wherein the polymer matrix is crosslinked with polyethyleneoxide or polyethyleneoxide-polypropyleneoxide compounds.

35. The method of claim 29, wherein the nitrogen atom in the fluorescent boronic acid is covalently coupled to the polymerized matrix via the group designated R^3.

36. The method of claim 35, wherein the atoms that link the fluorescent boronic acid to the polymerized matrix of polymer composition enhance the solubility of the polymer composition.

37. The method of claim 29, wherein the polymerized matrix is a polyvinylalcohol.

38. The method of claim 29, wherein the polymerized matrix is a polystyrene.

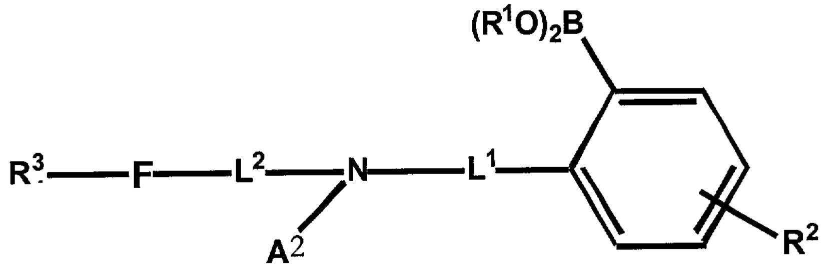
39. The method of claim 38, wherein the atomic group that is used to covalently couple the fluorescent boronic acid (FBA) to the polymer matrix (PM) is: HO-$(CH_2)_n$-FBA; NH_2-$(CH_2)_n$-FBA or NH_2-$(CH_2)_n$-$(O\text{-}CH_2CH_2)_n$-FBA wherein H is hydrogen, C is carbon, N is nitrogen, O is oxygen and n is an integer greater than or equal to 1.

40. The method of claim 38, wherein the tether that links the polymer matrix (PM) to the fluorescent boronic acid (FBA) includes the following atoms: PM-CO-NH-FBA; PM-SO_2-NH-FBA; PM-CO-NH-FBA; PM-COO-FBA; PM-NH-COO-FBA; PM-NH-CO-N-FBA or PM-NH-SO_2-FBA, wherein C denotes carbon, N denotes nitrogen, O denotes oxygen, S denotes sulfur and H denotes hydrogen.

41. The method of claim 29, wherein the fluorophore is highly soluble in water.

42. The method of claim 42, wherein the fluorophore is Nile Blue.

43. A method of coupling a fluorescent boronic acid (FBA) compound to a polymerized matrix (PM) to generate a polymerized matrix composition (PMC), wherein the fluorescent boronic acid compound has the general formula:



wherein:

F is a Fluorophore;

B is a boron atom;

R^1 is a hydrogen, aliphatic or aromatic group, wherein the group $(R^1O)_2B$ is capable of binding glucose;

R^2, and R^3 are optional hydrogen, aliphatic or aromatic groups;

L^1 and L^2 are optional linking groups having from zero to four nitrogen, carbon, oxygen, sulfur or phosphorous atoms; and

A^2 is a reactive group on the FBA that is used to attach the fluorescent boronic acid compound to the polymer matrix; and

wherein the resulting polymer composition (PMC) is produced by a reaction scheme:

$\text{PM-T}^1\text{-A}^1 + \text{A}^2\text{-T}^2\text{-FBA} \rightarrow \text{PM-T}^1\text{-A}^{1*}\text{A}^{2*}\text{-T}^2\text{-FBA}$

Wherein A^1 is a reactive group on the polymer matrix that is used to attach the polymer matrix to the fluorescent boronic acid compound;

T^1 is the group of atoms that tethers the polymerized matrix to the terminal reactive group on the polymerized matrix that is used to covalently couple the polymerized matrix to the fluorescent boronic acid compound; and

T^2 is the group of atoms that tethers the fluorescent boronic acid to the terminal reactive group on the fluorescent boronic acid that is used to covalently the polymerized matrix to the fluorescent boronic acid compound; and

wherein $A^{1*}A^{2*}$ represents the group of atoms that link the polymerized matrix to the fluorescent boronate compound after the reaction that results in their covalent attachment.